

REMARKS/ARGUMENTS

This is intended as a full and complete response to the Office Action dated December 9, 2004, having a shortened statutory period for response set to expire on March 9, 2005. Applicants request petition for a two month extension of time under 37 CFR Paragraph 1.136(a) up to and including May 9, 2005. Applicants have submitted a Request for Continued Examination.

The Examiner objects to the drawings under 37 CFR 1.83(a). Claims 27, 29 – 31, 33, 34, 35 – 38, 40, 42 – 44, and 48 – 52 stand rejected under 35 U.S.C. 112, first paragraph. Claims 27, 29, 30, 31, 33, 34, 49, and 50 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura et al. U.S. Patent No. 5,763,921 (hereafter Okumura) in view of Yuki et al. U.S. Patent No. 5,466,957, (hereafter Yuki) and Sanchez U.S. Patent No. 5,583,067 (hereafter Sanchez). Claims 35 - 38, 40, 42 - 44, 48, 51, and 52 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Yuki in view of Sanchez and Okumura.

Please enter the following amendments and reconsider the claims pending in the application for reasons discussed below. Applicants have amended claims 27, 35, 38, and 42. Claims 1-26, 28, 32, 39, 41, 45-52 have been canceled without prejudice to expedite prosecution of the application. Applicants have added new claims 53-58. Thus, claims 27, 29, 30-31, 33-38, 40, 42-44, and 53-58 are presented for examination. Applicants aver that no new matter has been introduced in this response.

Drawings

The Examiner objects to the drawings under 37 CFR 1.83(a). The Examiner states that the drawings must show every feature of the invention specified in the claims. Therefore, the "further doping the first pocket implant and the second pocket implant with a blanket implant" and "the first and second pocket implants are further doped with a blanket implant" must be shown or the feature(s) canceled from the claim(s). The Applicants have amended claims 27, 35, 38, and 42 to more clearly recite the invention and have removed "further doping the first pocket implant and the second pocket implant with a blanket implant" and "the first and second pocket implants are further doped with a blanket implant". Therefore, Applicants submit that the objection has been obviated and respectfully request the Examiner to withdraw the objection.

35 U.S.C. §112 Rejection

Claims 27, 29 – 31, 33, 34, 35 – 38, 40, 42 – 44, and 48 – 52

Claims 27, 29 – 31, 33, 34, 35 – 38, 40, 42 – 44, and 48 – 52 stand rejected under 35 U.S.C. 112, first paragraph. The Applicants have amended claims 27, 29 – 31, 33, 34, 35 – 38, 40, and 42 – 44 to more clearly recite the invention and have removed "further doping the first pocket implant and the second pocket implant with a blanket implant" and "the first and second pocket implants are further doped with a blanket implant". Therefore, Applicants submit that the rejection has been obviated and respectfully request the Examiner to withdraw the rejection.

35 U.S.C. §103(a) Rejection

Claim 27

Claim 27 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura in view Yuki and Sanchez. The Applicants respectfully assert that claim 27 is allowable over those references.

For example, claim 27 recites in part "diffusing the first pocket implant and the second pocket implant laterally in the semiconductor substrate to form a non-uniform dopant concentration throughout a channel region, the *non-uniform dopant concentration* (emphasis added) is configured to increase a punch-through voltage immunity threshold." Okumura, Yuki, and Sanchez, neither alone nor in combination, teach, show or suggest at least these claim elements. For example, Okumura teaches three impurity concentration peaks. Okumura teaches the creation of a first impurity concentration peak to provide a stop region, a second impurity peak to prevent latch up, and a third impurity concentration peak with both n and p components to prevent punch though and to increase the threshold voltage. Okumura does not teach a non-uniform dopant concentration is configured to increase a punch-through voltage immunity threshold. On the contrary, Okumura teaches that the third impurity concentration peak is uniformly doped across the channel region and that the threshold voltage and punch-through are adjusted by the doping concentration and heat processing and *not by considering the effective channel length and a lateral doping profile* (emphasis added) (See Abstract, FIG. 1, 4-6, 11-13, 18-19, 23-25, 30-31, col. 5, lines 26-49, col. 12, lines 29-60, col. 13 lines 1-10, col. 15 lines 22-34, col. 16 lines 42-52).

Yuki teaches injecting an impurity into a channel region of a substrate to form a high concentration layer of a first conductivity type, then injecting a second impurity at an angle into the upper region of the high concentration layer using a gate electrode as a mask to form a lower concentration layer of the first conductivity type. Then, an impurity of the second conductivity type is injected at an angle into the lower concentration layer to form a high concentration layer of the second conductivity type. Yuki teaches creating the high concentration

layer of a first conductivity type, then the lower concentration layer of the first conductivity type, and then finally a high concentration layer of a second conductivity type to increase the bonding pressure between the layers and therefore minimize current crowding. For example, Yuki teaches that a disadvantage exists in prior art methods in which before the formation of the source and drain region, doping of the high concentration p-type impurity is previously performed in a site intended to be the [source and drain] region. Thus, Yuki teaches the traditional formation of the layers decrease bonding pressure between the high concentration n-type impurity doped layer and the high concentration p-type layer which facilitates current crowding. Yuki is silent to a doping profile adjusted to increase punch-through voltage immunity. (See Abstract, FIG. 1-3, col. 1 lines 46-60). Therefore, as Yuki does not teach or suggest a non-uniform dopant concentration is configured to increase a punch-through voltage immunity threshold, Yuki does not make up for the deficiencies of Okumura.

Sanchez teaches self aligned punch-through stops. Sanchez suggests the channel implant (e.g., pocket implant) *adversely affects* (emphasis added) the sub-threshold slope (gate swing voltage) of the device and also affects threshold voltage. Sanchez also suggests that the lateral doping processes used with Yuki *forms transistors that exhibit several undesirable features* (emphasis added). First, Sanchez teaches the pocket implants do not surround the entire drain. This requires wells to be deeper to prevent punch-through leading to a reduction in packing densities. Second, the rotational aspect of the punch-through implant provides a doping uniformity which is dependent on the placement, shape, and layout of the fabricated transistor. Sanchez teaches that punch-through stop regions are formed in alignment where some of the Boron atoms may laterally diffuse. However, Sanchez teaches that the lateral diffusement of the Boron can be *minimized* (emphasis added) though heating. Therefore, Sanchez teaches away from lateral dopant injection taught in Yuki and therefore is not properly combinable with Yuki (See Abstract, FIG. 1-2, col. 1 lines 51-67, col. 2, lines 1-14, col. 7 lines 40-46).

Therefore, since claim 27 includes at least one element not disclosed or suggested by Okumura, Yuki, and Sanchez, or the combination thereof, claim 27 is allowable.

Claims 29-31, and 33-34

Claims 29, 30, 31, and 33-34, which depend from claim 27, are allowable for at least the reasons discussed in relation to claim 27, as well as the limitations they recite.

Claim 35

Claim 35 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Okumura in view of Yuki and Sanchez. The Applicants respectfully assert that claim 35 is allowable over those references.

Similar to the above argument regarding claim 27, claim 35 partially recites "diffusing the first and second pocket implants laterally causing the first pocket implant to merge with the second pocket implant at about a center portion of a channel disposed therebetween, the first and second pocket implants being diffused non-uniformly across the channel to adjust the punch-through voltage immunity." Yuki, Sanchez, and Okumura, neither alone nor in combination, teach, show or suggest pocket implants being diffused non-uniformly across the channel to adjust the punch-through voltage immunity. Notably, as mentioned above, Okumura teaches that the third impurity concentration peak is *uniformly doped* across the channel region and that the threshold voltage and punch-through are adjusted by the doping concentration and heat processing and *not by considering the effective channel length and a lateral doping profile* (emphasis added). Yuki teaches the traditional formation of the layers decreases bonding pressure between the high concentration n-type impurity doped layer and the high concentration p-type layer which facilitates current crowding and is silent to a doping profile adjusted to increase punch-through voltage immunity. As mentioned above, Sanchez teaches that the lateral diffusement of the Boron can be *minimized* (emphasis added) though heating. Therefore, Sanchez teaches away from lateral dopant injection taught in Yuki.

Therefore, since claim 35 includes at least one element not disclosed or suggested by Okumura, Yuki, and Sanchez, or the combination thereof, claim 35 is allowable.

Claims 36-37

Claims 36-37, which depend from claim 35, are allowable for at least the reasons discussed in relation to claim 35, as well as the limitations they recite.

Claim 38

Claim 38 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Yuki in view of Sanchez and Okumura. The Applicants respectfully assert that claim 38 is allowable over those references.

Similar to the above argument of claims 27 and 35, claim 38 partially recites "diffusing the first and second pocket implants laterally causing the first pocket implant to merge with the second pocket implant, wherein the first and second pocket implants are diffused non-uniformly across a channel region formed therebetween, and wherein the non-uniform diffusion is configured to increase the punch-through voltage threshold." Yuki, Sanchez, and Okumura, neither alone nor in combination, teach, show or suggest the non-uniform diffusion is configured to increase the punch-through voltage threshold. On the contrary, as mentioned above, Okumura teaches that the third impurity concentration peak is *uniformly doped* across the channel region and that the threshold voltage and punch-through are adjusted by the doping concentration and heat processing and *not by considering the effective channel length and a lateral doping profile* (emphasis added). Yuki teaches the traditional formation of the layers leads to a decreased bonding pressure between the high concentration n-type impurity doped layer and the high concentration p-type layer which facilitates current crowding and is silent to a doping profile adjusted to increase punch-through voltage immunity. As mentioned above, Sanchez teaches that the lateral diffusement of the Boron can be *minimized* (emphasis added) though heating. Therefore, Sanchez teaches away from lateral dopant injection taught in Yuki.

Therefore, since claim 38 includes at least one element not disclosed or suggested by Okumura, Yuki, and Sanchez, or the combination thereof, claim 38 is allowable.

Claim 40

Claim 40, which depends from claim 38, is allowable for at least the reasons discussed in relation to claim 38, as well as the limitations it recites.

Claim 42

Claim 42 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Yuki in view of Sanchez and Okumura. The Applicants respectfully assert that claim 42 is allowable over those references.

Similar to the above argument related to claims 27, 35, and 38, claim 42 partially recites "wherein the first and second pocket implants are diffused non-uniformly across a channel region formed therebetween, and wherein the non-uniform diffusion is configured to increase a threshold voltage of the transistor." Yuki, Sanchez, and Okumura, neither alone nor in combination, teach, show or suggest the *non-uniform diffusion is configured to increase a threshold voltage of the transistor* (emphasis added). Notably, as mentioned above, Okumura teaches that the third impurity concentration peak is *uniformly doped* across the channel region and that the threshold voltage and punch-through are adjusted by the doping concentration and heat processing and *not by considering the effective channel length and a lateral doping profile* (emphasis added). Yuki teaches the traditional formation of the layers decrease bonding pressure between the high concentration n-type impurity doped layer and the high concentration p-type layer which facilitates current crowding and is silent to a doping profile adjusted to increase punch-through voltage immunity. As mentioned above, Sanchez teaches that the lateral diffusement of the Boron can be *minimized* (emphasis added) though heating. Therefore, Sanchez teaches away from lateral dopant injection taught in Yuki.

Therefore, since claim 42 includes at least one element not disclosed or suggested by Okumura, Yuki, and Sanchez, or the combination thereof, claim 42 is allowable.

Claims 43-44

Claims 43-44, which depends from claim 42, are allowable for at least the reasons discussed in relation to claim 42, as well as the limitations they recite.

CONCLUSION

The prior art made of record is noted. However, it is believed that the secondary references are no more pertinent to the Applicants' disclosure than the primary references cited in the office action. Therefore, it is believed that a detailed discussion of the secondary references is not deemed necessary for a full and complete response to this office action.

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance and an action to that end is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at (415) 576-0200.

Respectfully submitted,



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